

10/665,322

REMARKS

Claims 18-32 all the claims pending in the application. Claims 20, 27, and 31 are objected to upon informalities. Claims 18-32 stand rejected on prior art grounds. Applicants respectfully traverse these objections/rejections based on the following discussion.

II. The Prior Art Rejections

Claims 18-32 stand rejected under 35 U.S.C. §102(e) as being anticipated by Brennan. (U.S. Patent No. 6,211,072). Applicants respectfully traverse this rejection because Brennan discloses including the nitride material through of the entire liner. To the contrary, the claimed invention has a barrier that is limited to the central portion of the liner. More specifically, independent claim 18 defines that the "barrier is limited to a central portion of said refractory metal" and claims 25 and 29 similarly define that the "barrier is limited to a central portion of said liner."

Brennan discloses that the passivating agent is formed through the entire liner (Office Action page 3, lines 5-7). More specifically, Brennan provides that the liner (adhesion layer 28) is formed through a chemical vapor deposition a (CVD) of TiCN (column 5, line 49-66). Therefore, Brennan clearly forms the passivating agent (nitrogen) throughout the entire liner. However, formation of a titanium nitride alloy contaminates the deposition chamber with large amounts of nitride and titanium, which requires that a separate deposition chamber be used, thus driving up the costs and increasing production time (see page 14, lines 16-22 of the application). Further, titanium nitride generally contains many defects which would reduce the effectiveness of the titanium liner. The invention avoids these disadvantages by forming the sub-stoichiometric barrier 20 in the same deposition chamber where (and at the same time when) the liner 13 is being formed.

Additionally, the invention limits the amount of passivating agent introduced during the liner formation to sub-stoichiometric levels. If an excessive amount of passivating agent (a

10/665,322

sufficient amount to form stoichiometric titanium nitride) is introduced during the liner deposition (as in Brennan), the liner deposition rate would be severely reduced. Further, excessive amounts of nitrogen (as in Brennan) cause titanium to grow in columns. The space between such columns provides a path for the fluorine used in the subsequent tungsten CVD process to react with the underlying silicon, again allowing the formation of undesirable fluorine compounds (see page 15, lines 3-10 of the application).

Therefore, the inventive structure that has the barrier limited to the central portion of liner is superior to the structure described in Brennan, and Brennan cannot teach or suggest the claimed structure. More specifically, Brennan does not teach or suggest that the "barrier is limited to a central portion of said refractory metal" as defined by independent claim 18 or that the "barrier is limited to a central portion of said liner" as defined by independent claims 25 and 29. Therefore, it is Applicants position that independent claims 18, 25, and 29 are patentable over Brennan. Dependent claims 19-24, 26-28, and 30-32 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

III. Formal Matters and Conclusion

With respect to the objections to the claims, claims 20, 27, and 31 have been corrected. More specifically, in claim 20, the "first conductive layer" has been reworded to read the "adjacent conductive layer." Claims 27 and 31 have been reworded from "refractory metal" to "liner." Applicants submit that claims are free of the informalities and respectfully request that the Examiner reconsider and withdraw these objections.

In view of the foregoing, Applicants submit that claims 18-32, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

10/665,322

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

Dated: 7/1/04

Frederick W. Gibb, III
Reg. No. 37,629

McGinn & Gibb, PLLC
2568-A Riva Road
Suite 304
Annapolis, MD 21401
Customer Number: 29154